

ME 1653 C.2

# INSTRUCTION MANUAL

## DISTRIBUTION AMPLIFIER

MODEL 203-3

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**MONTRONICS INC.**  
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SEATTLE, WASHINGTON



**INSTRUCTION MANUAL**

**DISTRIBUTION  
AMPLIFIER**

**MODEL 203-3**

**(MONTRONICS)**

**APRIL 1966**

**(REVISED NOVEMBER 3, 1975)**

**(Revised for the NASA)**

Prepared for  
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**  
**(Original Manual Prepared by Montronics, Inc.)**



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## RECORD-OF-CHANGES

| DATE OF REVISION | CONTRACTOR & AUTHORITY                      | DESCRIPTION OF CHANGE                                                      | DATE OF REVISION | CONTRACTOR & AUTHORITY | DESCRIPTION OF CHANGE |
|------------------|---------------------------------------------|----------------------------------------------------------------------------|------------------|------------------------|-----------------------|
| March 7, 1969    | Bendix<br>NAS5-10750<br>TD 626<br>OMPUB-280 | EI-3135                                                                    |                  |                        |                       |
| November 3, 1975 | Bendix<br>NAS5-23000<br>DWR 4054            | EC's:<br>0288<br>0288, Ch. 1<br><br>1717<br><br>EI:<br>4831<br>4831, Ch. 1 |                  |                        |                       |



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# SECTION I

## GENERAL DESCRIPTION

### 1-1. INTRODUCTION

The Montronics Model 203-3 Distribution Amplifier (see figure 1-1) is an all solid-state unit which accepts three input frequencies of 0.1 Mc, 1 Mc, and 5 Mc and provides ten, fifteen, and five isolated outputs at each of these frequencies. However, multiple combinations of these outputs are possible.

Intended for the distribution of standard frequencies, the unit incorporates three preamplifiers, one for each frequency, followed by ten, fifteen, and five amplifiers for each of the three frequencies. However, multiple amplifier combinations are possible. The preamplifiers and amplifiers are designed for low-noise and linear operation so that the high purity of the input signal is preserved.

#### NOTE

At BDA and MAD one amplifier has been modified for ten 1-Mc and twenty 5-Mc amplifier outputs. At GDS and MIL one amplifier has been modified for ten outputs for each input frequency and another amplifier for thirty 5-Mc outputs (see table 1-1).

The Model 203-3 includes the following plug-in modules:

| <u>Quantity</u> | <u>Description</u>  | <u>Montronics<br/>Part No.</u> | <u>Length x Width x Height</u> |
|-----------------|---------------------|--------------------------------|--------------------------------|
| 1               | Power Supply        | 203-3-401                      | 4" x 2-3/8" x 5/8"             |
| 1               | 0.1 Mc Preamplifier | 203-3-402                      | 4" x 2-3/8" x 5/8"             |
| 1               | 1 Mc Preamplifier   | 203-3-403                      | 4" x 2-3/8" x 5/8"             |
| 1               | 5 Mc Preamplifier   | 203-3-404                      | 4" x 2-3/8" x 5/8"             |
| 10              | 0.1 Mc Amplifier    | 203-3-407                      | 4" x 2-3/8" x 5/8"             |
| 15              | 1 Mc Amplifier      | 203-3-406                      | 4" x 2-3/8" x 5/8"             |
| 5               | 5 Mc Amplifier      | 203-3-405                      | 4" x 2-3/8" x 5/8"             |

See table 1-1 for applicable station quantities of plug-in modules. (One amplifier module per channel output).



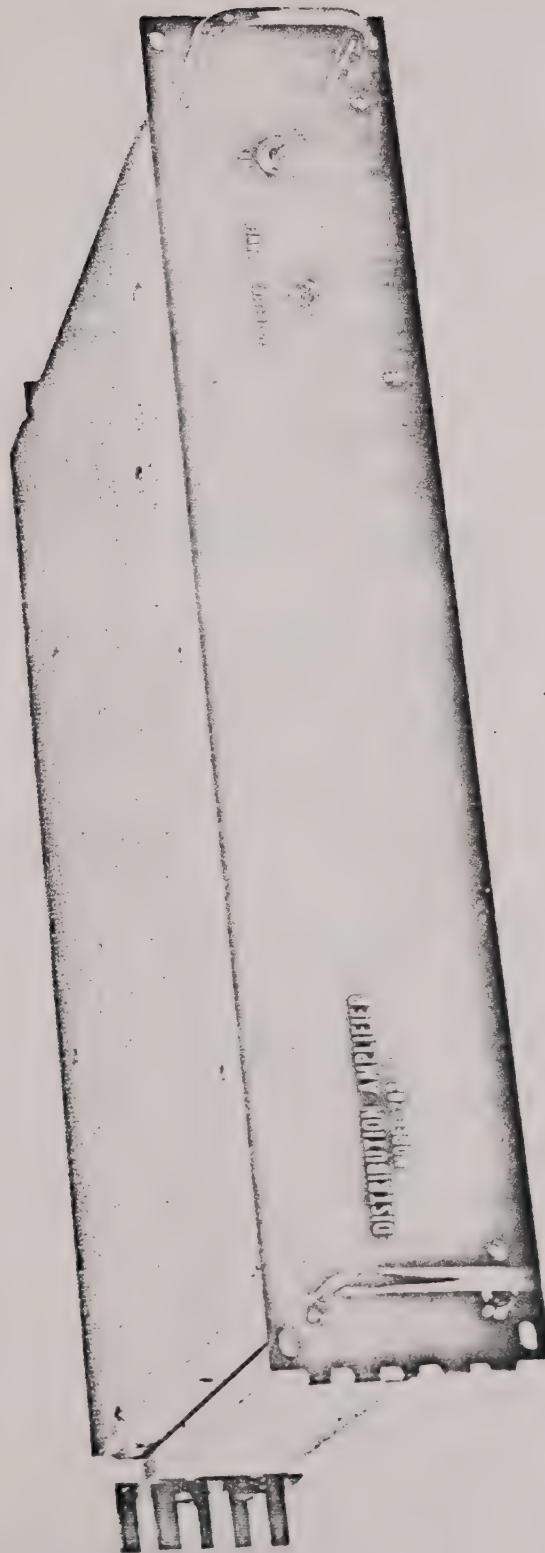


Figure 1-1. THE MODEL 203-3 DISTRIBUTION AMPLIFIER



Packed with the instrument is an accessory package consisting of the following:

| <u>Quantity</u> | <u>Description</u>     | <u>Montronics Part No.</u> |
|-----------------|------------------------|----------------------------|
| 1               | Module Riser           | 203-2-407                  |
| 1               | Module Puller          | 302-225                    |
| 1               | Shorting BNC Connector | 203-2-412                  |
| 1               | JFD Tuning Tool        | 153409                     |
| 1               | Mullard Tuning Tool    |                            |

## 1-2. SPECIFICATIONS

### Input Characteristics:

|            |                                                                                                                |
|------------|----------------------------------------------------------------------------------------------------------------|
| Frequency: | Three separate input channels, one each for .1 Mc, 1 Mc, and 5 Mc.                                             |
| Level:     | The amplifier shall accept signals of up to 2 volts rms. An input level adjustment is provided for each input. |
| Impedance: | The input impedance is greater than 500 ohms at each input.                                                    |

### Output Characteristics:

|                     |                                                                                                                                              |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| *Number of Outputs: | Total of 30 output channels with 5 outputs at 5 Mc, 15 outputs at 1 Mc, and 10 outputs at .1 Mc.                                             |
| Level:              | The output level at each channel is 1.0 volt rms (-0/+3 db) across 50 ohms over temperature range when the input is a constant 1.0 volt rms. |
| Bandwidth:          | The bandwidth of each frequency is less than 3% of input frequency for 3 db down and 15% for 30 db down.                                     |
| Spurious:           | Any spurious is more than 80 db below the desired output.                                                                                    |
| Harmonics:          | All harmonics are greater than 60 db below the fundamental.                                                                                  |

\*See table 1-1 for applicable station variations.



|                     |                                                                                                                                                                                                                                    |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Isolation:          | With all inputs energized, the signal level at any output connector is changed less than $\pm .25$ db when any other output is short-circuited. There is at least 50-db isolation between outputs from externally induced signals. |
| Cross-Talk:         | With one input channel excited, the presence of that signal at any of the other frequency outputs shall be in excess of 50 db below the desired output level.                                                                      |
| Noise & Hum Level:  | Total noise and hum level is equivalent to an input of less than 100 microvolts rms at maximum gain.                                                                                                                               |
| Time Delay Jitter:  | Less than $10^{-5}$ cycle rms for all three frequency instability of less than $1 \times 10^{-11}$ standard deviation for a one second averaging time of 1 mc.                                                                     |
| Power Requirements: | 115 vac, $\pm 10\%$ , 50-400 cps single phase.                                                                                                                                                                                     |
| Mechanical:         |                                                                                                                                                                                                                                    |
| Size:               | 3-1/2" high x 19" wide x 14" deep for standard rack mounting.                                                                                                                                                                      |
| Weight:             | Less than 20 pounds.                                                                                                                                                                                                               |
| Connections:        | 3 insulated input and 30 output BNC connectors on rear.                                                                                                                                                                            |
| Controls:           | Power switch, pilot light and fuse on panel.                                                                                                                                                                                       |
| Environmental:      |                                                                                                                                                                                                                                    |
| Non Operating:      | Temperature $-55^{\circ}\text{C}$ to $+72^{\circ}\text{C}$ .<br>Humidity: 0% to 100% relative.                                                                                                                                     |
| Operating:          | Operate to specifications from 0 to $50^{\circ}\text{C}$ and 20% to 80% relative humidity. Survive and operate, but with degraded performance from 80% to 95% relative humidity.                                                   |



# Fuses and Semiconductors:

|         |   |        |   |        |    |
|---------|---|--------|---|--------|----|
| MDL 1/2 | 1 | 2N1039 | 1 | 2N2218 | 26 |
| 2N297A  | 1 | 2N1303 | 1 | 2N697  | 40 |

Table 1-1. Station Configuration, Distribution Amplifier

| Station        | Amplifier | Channel Desig.                        | Outputs (MHz's)       |
|----------------|-----------|---------------------------------------|-----------------------|
| BDA and<br>MAD | No. 1     | 1 thru 5<br>6 thru 20<br>21 thru 30   | 5 Mc<br>1 Mc<br>.1 Mc |
|                | No. 2     | 1 thru 20<br>21 thru 30               | 5 Mc<br>1 Mc          |
| GDS and<br>MIL | No. 1     | 1 thru 10<br>11 thru 20<br>21 thru 30 | 5 Mc<br>1 Mc<br>.1 Mc |
|                | No. 2     | 1 thru 30                             | 5 Mc                  |



## SECTION II

### INSTALLATION

#### 2-1. GENERAL

The unit should be unpacked and checked carefully for visible damage. The top cover should be removed and all printed circuit modules pressed firmly in place.

Installation of the Model 203-3 is straightforward. The unit is designed to be mounted in a standard 19" rack. Power cord, input connectors, input level adjust controls, and output connectors are all located on the rear apron of the instrument and are clearly marked as shown in figure 2-2. The front panel contains the power switch, pilot light and 1/2 amp slo-blo fuse. A typical interconnection diagram is shown in figure 2-1.

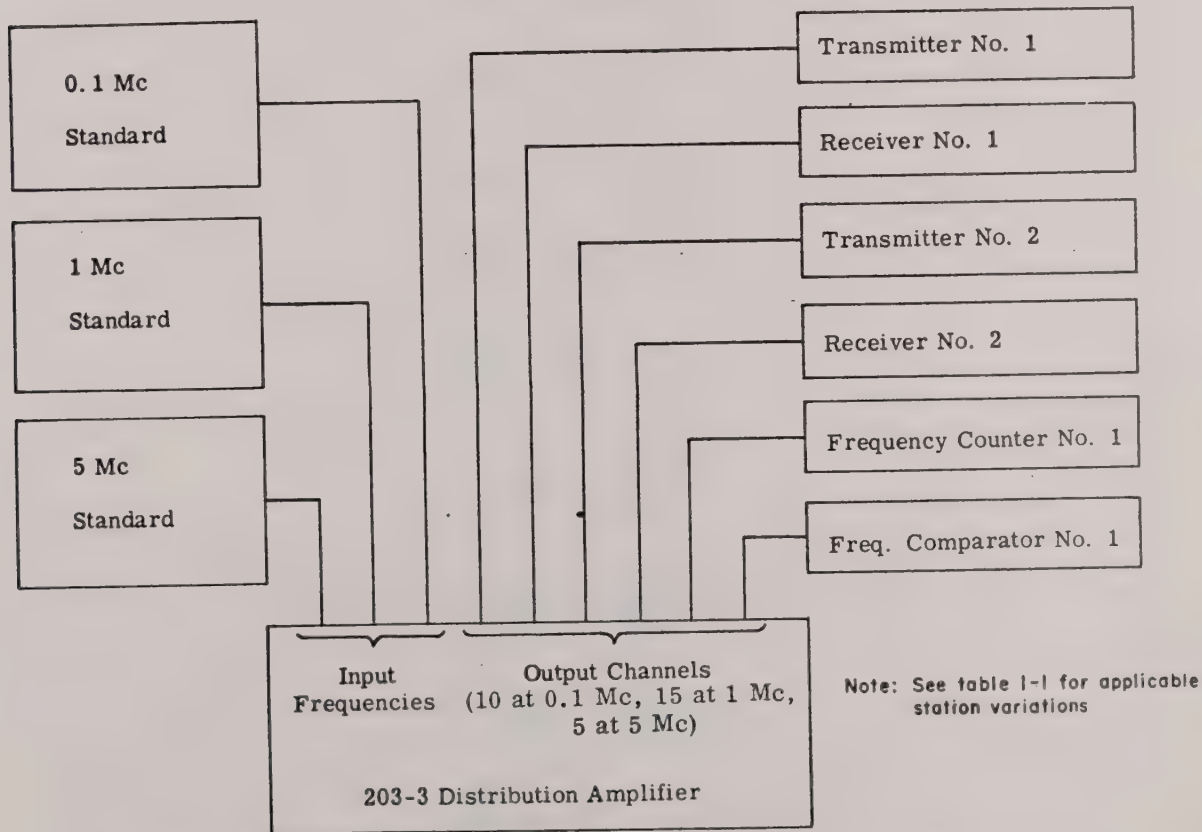
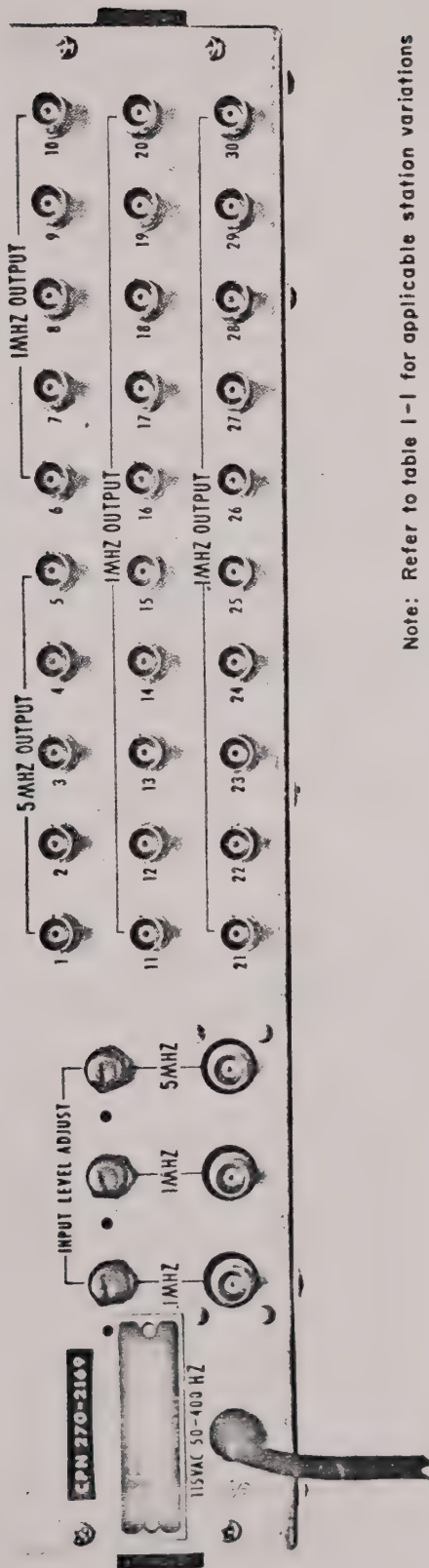


Figure 2-1. TYPICAL 203-3 INTERCONNECTION DIAGRAM





Note: Refer to table I-1 for applicable station variations

Figure 2-2. LOCATION OF INPUT AND OUTPUT CONNECTORS



## SECTION III

### OPERATION

#### 3-1. CONTROLS, TERMINALS, AND INDICATORS

The following controls, terminals, and indicators are located on the front panel (figure 3-1) or the rear apron (figure 2-2) of the instrument.

- a. The POWER switch applies line voltage to the primary of the power transformer.
- b. The POWER lamp illuminates when the 22-volt dc power supply is operating.
- c. The .5A SLO-BLO fuse holder contains a 0.5 ampere slow-blowing fuse which is located in the primary circuit of the transformer.
- d. The 5MC, 1MC, and .1MC BNC input connectors are for connection to the 5 Mc, 1 Mc, and 0.1 Mc local frequency standards.
- \*e. The 5MC, 1MC, and .1MC OUTPUT BNC connectors provide five channels for 5 Mc (CH1 to CH 5), fifteen channels for 1 Mc (CH 6 to CH 20), and ten channels for 0.1 Mc (CH 21 to CH 30) frequencies to be distributed throughout a laboratory or manufacturing facility.
- f. The INPUT LEVEL ADJUST controls for 5MC, 1MC, and .1MC are used to adjust the input level until the proper output level of 1 volt is available for the 5 Mc, 1 Mc, and 0.1 Mc channels.

#### 3-2. OPERATING INSTRUCTIONS

- a. Connect power plug to a 115-volt ac power outlet.
- b. Connect 5 Mc, 1 Mc, and 0.1 Mc local frequency standards having a level between 1 and 2 volts to 5MC, 1MC, and .1MC BNC input connectors on rear of instrument.
- c. Set POWER switch to ON. POWER lamp will illuminate, indicating that 22-volt dc power supply is operating.
- d. Adjust 5MC INPUT LEVEL ADJUST control for an output level of 1 volt rms as measured with a suitable voltmeter (such as the Fluke Model 910A) at any output channel from 1 to 5 that is properly loaded with 50 ohms.
- e. Adjust 1MC INPUT LEVEL ADJUST control for an output level of 1 volt rms on any channel from 6 to 20.
- f. Adjust .1MC INPUT LEVEL ADJUST control for an output level of 1 volt rms on any channel from 21 to 30.

\*For applicable station variations refer to paragraph 1-1, Section I, Introduction.



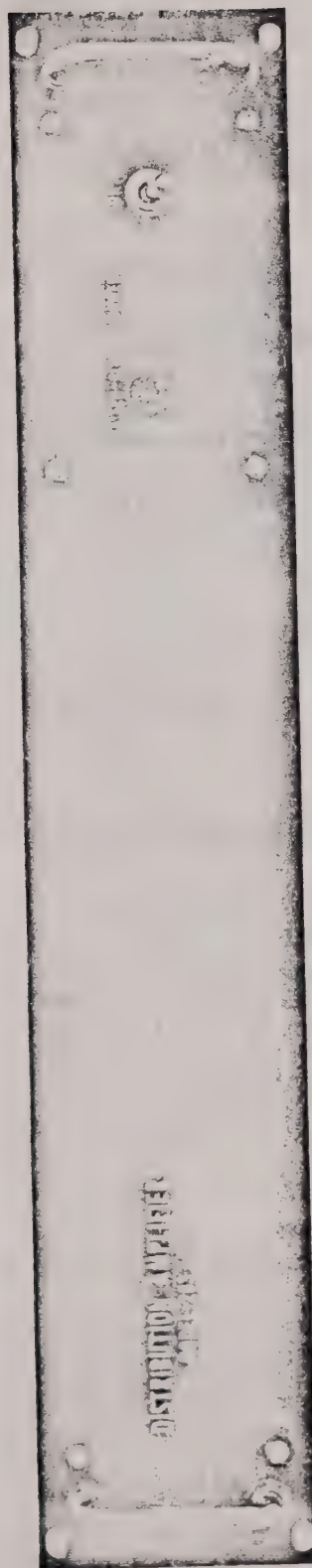


Figure 3-1. LOCATION OF FRONT PANEL CONTROLS AND INDICATORS



## SECTION IV

### THEORY OF OPERATION

#### 4-1. INTRODUCTION

Figure 4-1 shows the block diagram for the 203-3 Distribution Amplifier. The circuit consists of three preamplifier modules, thirty amplifier modules, and a power supply module. The overall operation may be summarized as follows: An isolated BNC connector located on the rear panel is provided for each of the three input frequencies, 0.1 Mc, 1 Mc, and 5 Mc. Each connector feeds the applied signal to a preamplifier tuned to that frequency. The output of each preamplifier is applied to each and every amplifier module connector. Each amplifier module connector has its own BNC output connector on the rear panel. It is thus possible to have any of the three frequencies available at any one of the output connectors by inserting an amplifier module tuned to the desired frequency in the correct amplifier module connector. However, the rear panel is marked for, and the amplifier modules are inserted so that, channels 1 to 5 are for 5 Mc, channels 6 to 20 are for 1 Mc, and channels 21 to 30 are for 0.1 Mc. For applicable station variations refer to paragraph 1-1, Section I, Introduction.

#### 4-2. PREAMPLIFIERS

Reference: Drawing No. 203-3-102 (.1 Mc) 203-3-103 (1 Mc), 203-3-104 (5 Mc)

The preamplifiers are similar except for the tuned circuit elements. Each preamplifier consists of a push-pull, common-emitter, class AB amplifier with a tuned-base input circuit and a tuned-collector output circuit. The INPUT LEVEL ADJUST on the rear apron allows for proper excitation of the preamplifier over a wide range of input levels. Diode CR1 and resistor R4 provide a slight forward bias to the push-pull transistors to minimize crossover distortion. Emitter resistors R2 and R3 provide both ac and dc stabilization. The preamplifier output is available at the secondary of T2.

#### 4-3. AMPLIFIERS

Reference: Drawing No. 203-3-107 (.1 Mc), 203-3-106 (1 Mc), 203-3-105 (5 Mc)

The amplifier module is similar to the preamplifier module except that it has a double-tuned output circuit. This provides greater selectivity and rejection to harmonics. T2 and T3 work together to form a double-tuned circuit with the mutual coupling impedance being provided by C5. The double-tuned output stage



is under critically-coupled and hence has a single-humped response. When the amplifier output is loaded into 50 ohms most of the power is delivered to the load with very little loss in the tuned circuits. When the output is open-circuited the losses of T3 absorb most of the ac signal power. Consequently the dc power input to the stage remains essentially constant regardless of load. This also provides for a high degree of inter-channel isolation.

#### 4-4. POWER SUPPLY

Reference: Drawing No. 203-3-101

The power supply consists of a step-down transformer and a bridge rectifier to convert the line voltage into nominally 30 volts dc. This is followed by a series-type regulator which provides relatively constant output voltage under varying line and load conditions. The output voltage is maintained at the nominal zener voltage of the voltage reference diode, CR5, which is 22 volts. If a change in the line voltage or load conditions tends to increase the output voltage, the base-emitter voltage of Q2 increases causing its collector current to increase which robs some of the base current from Q1 and subsequently reduces the base current of Q1 on the chassis, thus reducing the output voltage.



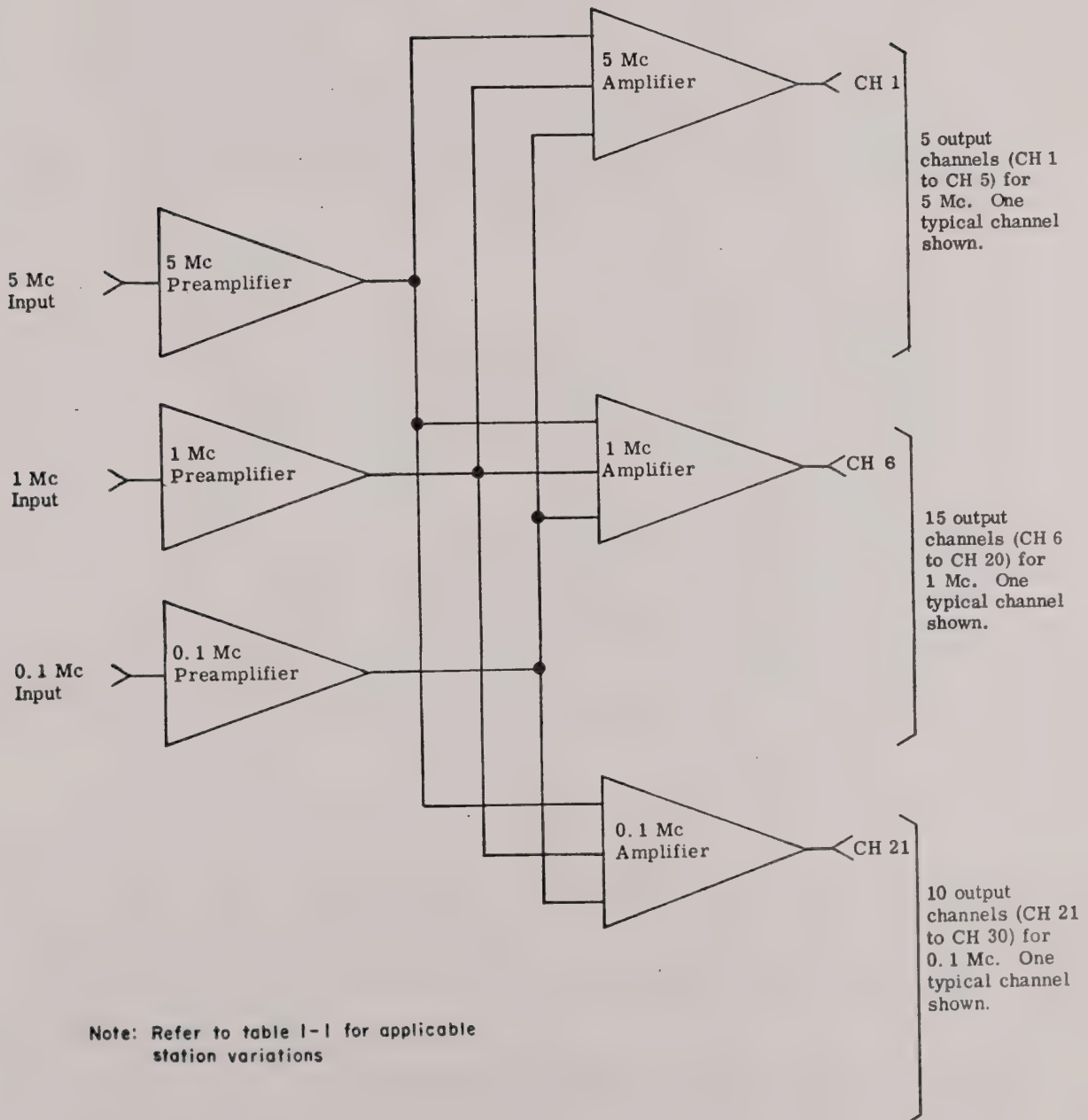


Figure 4-1. BLOCK DIAGRAM FOR 203-3 DISTRIBUTION AMPLIFIER



## SECTION V

### MAINTENANCE

#### 5-1. INTRODUCTION

The Model 203-3 is unusually easy to maintain because of its simplicity of operation, high degree of reliability, and accessibility of all components. Because of the modular construction, the preamplifiers, amplifiers, and power supply may be removed from the top of the instrument and placed on a module riser to facilitate calibration and troubleshooting.

#### 5-2. TROUBLESHOOTING

The key to troubleshooting any electronic instrument is (1) fully understanding the operation of the instrument and each of its stages and (2) localizing the trouble to a stage and then a part through a logical troubleshooting procedure. Thus, an understanding of the theory of operation (Section IV) and frequent reference to the schematic diagrams will be of great value in troubleshooting. One of the best methods to localize the trouble to a stage is to perform the calibration procedure. If all three preamplifiers can not be aligned, the trouble is in the power supply. If one preamplifier can not be aligned, the trouble is in the preamplifier. If the preamplifiers are operating correctly and an amplifier can not be aligned, the trouble is in that amplifier. If there is trouble with gain in all the amplifiers, the power supply voltage is not within 5% of 22 vdc. If there is excessive noise at each of the amplifier outputs, the power supply probably has excessive ripple. A check of the transistor terminal voltages (figure 5-1) is also helpful at certain times.

#### 5-3. CALIBRATION

#### 5-4. PREAMPLIFIER ALIGNMENT

a. Connect 5 Mc, 1 Mc, and 0.1 Mc local frequency standards having a level between 1 and 2 volts to 5MC, 1MC, and .1MC BNC input connectors on rear of instrument.

b. Place module riser, 203-2-407, between preamplifier connector and preamplifier being aligned.

c. Set POWER switch to ON.

d. Adjust T1 and T2 on preamplifier module for maximum output as indicated on a suitable voltmeter (such as the FLUKE 910A) connected across pins 9 and 10 of the module.

e. Repeat steps b to d for remaining preamplifier modules.



## 5-5. AMPLIFIER ALIGNMENT

- a. Connect 5 Mc, 1 Mc, and 0.1 Mc local frequency standards having a level between 1 and 2 volts to 5MC, 1MC, and .1MC BNC input connectors on rear of instrument.
- b. Place module riser, 203-2-407, between amplifier connector and amplifier being aligned.
- c. Set POWER switch to ON.
- d. Connect voltmeter ground lead to TP2 (circuit ground) and input lead to TP1 (collector of Q1).
- e. Short amplifier output by connecting special shorting BNC connector, 203-2-412, to amplifier output connector.
- f. Adjust T1 and T2 for maximum indication on voltmeter.

### NOTE

The INPUT LEVEL ADJUST control should be adjusted so that the voltmeter indicates less than 10 volts. Otherwise collector limiting will occur and the adjustment of T1 and T2 will not vary the collector level.

- g. Remove shorting connector and adjust T3 for a minimum voltmeter indication.
- h. Repeat steps b to g for remaining amplifier modules.

## 5-6. AMPLIFIER GAIN

- a. Connect 5 Mc, 1 Mc, and 0.1 Mc local frequency standards having a level between 1 and 2 volts to 5MC, 1MC, and .1MC BNC input connectors on rear of instrument.
- b. Place module riser, 203-2-407, between preamplifier connector and 5 Mc preamplifier.
- c. Set POWER switch to ON.
- d. Adjust INPUT LEVEL ADJUST control for a preamplifier output of 1.25 volts as measured with a voltmeter across pins 9 and 10.
- e. Repeat steps b to d for 1 Mc and 0.1 Mc preamplifier modules.
- f. Place module riser between amplifier connector and amplifier being adjusted.
- g. Adjust R1 on amplifier module for an output level of 1.25 volts as measured with a voltmeter at the corresponding output connector properly loaded with 50 ohms.



## NOTE

At this level the collectors of the preamplifier transistors should show about 4.5 vac for 0.1 Mc, 5.0 vac for the 1 Mc, and 5.7 vac for the 5 Mc. The amplifier transistor collector (TP1) should show about 4.8, 2.5, and 1.8 vac for 0.1 Mc, 1 Mc, and 5 Mc respectively.

- h. Repeat steps f and g for remaining amplifier modules.

| TRANSISTOR   | EMITTER | BASE  | COLLECTOR |
|--------------|---------|-------|-----------|
| 203-3-100 Q1 | 0       | -0.37 | -6.2      |
| 203-3-101 Q1 | -0.37   | -0.5  | -6.2      |
| 203-3-101 Q2 | 22      | 21.8  | -0.5      |
| 203-3-102 Q1 | 0.24    | 0.66  | 21.9      |
| 203-3-102 Q2 | 0.24    | 0.66  | 21.9      |
| 203-3-103 Q1 | 0.24    | 0.66  | 21.9      |
| 203-3-103 Q2 | 0.24    | 0.66  | 21.9      |
| 203-3-104 Q1 | 0.03    | 0.51  | 21.9      |
| 203-3-104 Q2 | 0.03    | 0.51  | 21.9      |
| 203-3-105 Q1 | 0.03    | 0.51  | 21.9      |
| 203-3-105 Q2 | 0.03    | 0.51  | 21.9      |
| 203-3-106 Q1 | 0.24    | 0.66  | 21.9      |
| 203-3-106 Q2 | 0.24    | 0.66  | 21.9      |
| 203-3-107 Q1 | 0.24    | 0.66  | 21.9      |
| 203-3-107 Q2 | 0.24    | 0.66  | 21.9      |

The above operating voltage levels are measured under the following conditions: (a) POWER switch set to ON; (b) 5 Mc, 1 Mc, and 0.1 Mc local frequency standards connected to input; (c) all measurements made from chassis ground to specified terminal with a 20,000 ohms per volt voltmeter; (d) all voltages are dc; (e) voltages may vary as much as 15 to 20%; (f) bias voltages (difference between emitter and base voltages) should remain approximately the same.

Figure 5-1. TRANSISTOR OPERATING VOLTAGE LEVELS



## SECTION VI

## PARTS LIST

The parts used in this unit have been carefully selected to assure maximum reliability. Should component replacement become necessary, identical components should be used. All parts are available from the manufacturers indicated on the parts list or from MONTRONICS, INC. Any abbreviations or contractions used here or on the schematics are standard in the industry.

0.1 MC PREAMPLIFIER, 203-3-402, Drawing No. 203-3-102

| Reference Designation | Description                                | Type      | Manufacturer |
|-----------------------|--------------------------------------------|-----------|--------------|
| C1, 2                 | Capacitor, .037 ufd                        | 1PC373G   | Arco         |
| C5                    | Capacitor, disc, .68 ufd, 25 V             | 5C12      | Sprague      |
| CR1                   | Diode                                      | 154799    | Montronics   |
| FL1                   | Inductor, 330 uh                           | WEE-330   | Essex        |
| P1                    | Connector, 10 Pin                          | 149369    | Montronics   |
| Q1, 2                 | Transistor                                 | 2N2218    | Motorola     |
| R1                    | Resistor, composition, 1/4 W, 5%, 680 ohms | 148007    | Montronics   |
| R2, 3                 | Resistor, composition, 1/4 W, 5%, 15 ohms  | 147876    | Montronics   |
| R4                    | Resistor, composition, 1/4 W, 5%, 15 K     | 148114    | Montronics   |
| R6                    | Resistor, composition, 1/4 W, 5%, 2.2 K    | 148049    | Montronics   |
| T1                    | Transformer                                | 203-613   | Montronics   |
| T2                    | Transformer                                | 203-610   | Montronics   |
|                       | Transipads                                 | 152207    | Montronics   |
|                       | .1 MC Preamp PCB                           | 203-3-302 | Montronics   |



1 MC PREAMPLIFIER, 203-3-403, Drawing No. 203-3-103

| Reference<br>Designation | Description                                   | Type      | Manufacturer       |
|--------------------------|-----------------------------------------------|-----------|--------------------|
| C1                       | Capacitor, Dipped Mica, 3900 pf<br>5%         | 160325    | Montronics         |
| C2                       | Capacitor, dipped mica, 5000 pf<br>5%         | CD19F502J | Federal<br>Pacific |
| C3, 4                    | Capacitor, dipped mica, 5 pf<br>10%           | 148577    | Montronics         |
| C5                       | Capacitor, disc, .05 ufd, 50 V,<br>+80%, -20% | 159161    | Montronics         |
| CR1                      | Diode                                         | 154799    | Montronics         |
| FL1                      | Inductor, 330 uh                              | WEE-330   | Essex              |
| P1                       | Connector, 10 Pin                             | 149369    | Montronics         |
| Q1, 2                    | Transistor                                    | 2N2218    | Motorola           |
| R1                       | Resistor, composition, 1/4 W,<br>5%, 470 ohms | 147983    | Montronics         |
| R2, 3                    | Resistor, composition, 1/4 W,<br>5%, 15 ohms  | 147876    | Montronics         |
| R4                       | Resistor, composition, 1/4 W,<br>5%, 15 K     | 148114    | Montronics         |
| R6                       | Resistor, composition, 1/2 W,<br>5%, 2.2K     | 108506    | Montronics         |
| T1                       | Transformer                                   | 203-618   | Montronics         |
| T2                       | Transformer                                   | 203-604   | Montronics         |
|                          | Transipads                                    | 152207    | Montronics         |
|                          | 1 MC Preamplifier PCB                         | 203-3-303 | Montronics         |



5 MC PREAMPLIFIER, 203-3-404, Drawing No. 203-3-104

| Reference<br>Designation | Description                                   | Type      | Manufacturer |
|--------------------------|-----------------------------------------------|-----------|--------------|
| C1, 2                    | Capacitor, dipped mica,<br>1000 pf 5%         | 148387    | Montronics   |
| C3, 4                    | Capacitor, dipped mica, 5 pf<br>5%            | 148577    | Montronics   |
| C5                       | Capacitor, Disc, .05 uf, 50 V,<br>+80%, -20%  | 149161    | Montronics   |
| CR1                      | Diode                                         | 154799    | Montronics   |
| FL1                      | Inductor, 22 uh, 10%                          | 147843    | Montronics   |
| P1                       | Connector, 10 Pin                             | 149369    | Montronics   |
| Q1, 2                    | Transistor                                    | 2N2218    | Motorola     |
| R1                       | Resistor, composition, 1/4 W,<br>5%, 390 ohms | 147975    | Montronics   |
| R2, 3                    | Resistor, composition, 1/4 W,<br>5%, 10 ohms  | 147876    | Montronics   |
| R4                       | Resistor, composition, 1/4 W,<br>5%, 15 K     | 148114    | Montronics   |
| R6                       | Resistor, composition, 1/2 W,<br>5%, 2.2 K    | 108506    | Montronics   |
| T1                       | Transformer                                   | 203-619   | Montronics   |
| T2                       | Transformer                                   | 203-607   | Montronics   |
|                          | Transipads                                    | 152207    | Montronics   |
|                          | 5 MC Preamplifier PCB                         | 203-3-304 | Montronics   |



POWER SUPPLY, 203-3-401, Drawing No. 203-3-101

| Reference Designation | Description                              | Type      | Manufacturer      |
|-----------------------|------------------------------------------|-----------|-------------------|
| C1                    | Capacitor, disc, .68 ufd, 25 V           | 5C12      | Sprague           |
| CR1 through 4         | Diode                                    | 1N4002    | Motorola          |
| CR5                   | Diode, Zener                             | 1N969B    | Motorola          |
| P1                    | Connector, 10 Pin                        | 149369    | Montronics        |
| Q1                    | Transistor                               | 2N1039    | Texas Instruments |
| Q2                    | Transistor                               | 2N1303    | Texas Instruments |
| R1                    | Resistor, composition, 1 W, 5%, 680 ohms | GB6815    | Allen-Bradley     |
| R2                    | Resistor, composition, 1 W, 5%, 1.8 K    | GB1825    | Allen-Bradley     |
| R3                    | Resistor, composition, 1/4 W 5%, 68 ohms | 147918    | Montronics        |
|                       | Heat Sink (2 required)                   | 104562    | Montronics        |
|                       | Transipads                               | 152207    | Montronics        |
|                       | Power Supply PCB                         | 203-3-301 | Montronics        |



. 1 MC AMPLIFIER, 203-3-407, Drawing No. 203-3-107

| Reference<br>Designation | Description                                  | Type      | Manufacturer      |
|--------------------------|----------------------------------------------|-----------|-------------------|
| C1                       | Capacitor, .037 ufd                          | 1PC373G   | Arco              |
| C2                       | Capacitor, .015 ufd                          | 1PC153G   | Arco              |
| C3                       | Capacitor, 01 ufd, $\pm 2\%$ , 100 V         | 168385    | Montronics        |
| C4                       | Capacitor, disc, .68 uf, 25 V                | 5C12      | Sprague           |
| C5                       | Capacitor, dipped mica, 1500 pf<br>5%        | 148361    | Montronics        |
| CR1                      | Diode                                        | 154799    | Montronics        |
| FL1                      | Inductor, 330 uh, 5%                         | WEE-330   | Essex             |
| P1                       | Connector, 10 Pin                            | 149369    | Montronics        |
| Q1, 2                    | Transistor                                   | 2N697     | Motorola          |
| R1                       | Potentiometer, Series 4,<br>Type 600-1, 10 K | 600-1     | Centralab         |
| R2, 3                    | Resistor, composition, 1/4 W<br>5%, 15 ohms  | 147876    | Montronics        |
| R4                       | Resistor, composition, 1/4 W<br>5%, 15 K     | 148114    | Montronics        |
| R5                       | Resistor, composition, 1/4 W<br>5%, 10 ohms  | 148007    | Montronics        |
| T1                       | Transformer                                  | 203-610   | Montronics        |
| T2                       | Transformer                                  | 203-611   | Montronics        |
| T3                       | Transformer                                  | 203-612   | Montronics        |
|                          | Terminal Post                                | 2010B     | Litton Industries |
|                          | Transipads                                   | 152207    | Montronics        |
|                          | . 1 MC Amplifier PCB                         | 203-3-407 | Montronics        |



1 MC AMPLIFIER, 203-3-406, Drawing No. 203-3-106

| Reference<br>Designation | Description                                      | Type      | Manufacturer       |
|--------------------------|--------------------------------------------------|-----------|--------------------|
| C1, 2                    | Capacitor, dipped mica,<br>5000 pf, 5%, 100 V    | CD19F502J | Federal<br>Pacific |
| C3                       | Capacitor, dipped mica,<br>1200 pf, 5%, 100 V    | 148379    | Montronics         |
| C4                       | Capacitor, disc, .05 uf, 50 V<br>+80%, -20%      | 149161    | Montronics         |
| C5                       | Capacitor, dipped mica,<br>330 pf, 5%, 100 V     | 148445    | Montronics         |
| C6, 7                    | Capacitor, dipped mica, 5 pf,<br>5%, 100 V       | 148577    | Montronics         |
| CR1                      | Diode                                            | 154799    | Montronics         |
| FL1                      | Inductor, 330 uh, 5%                             | WEE-330   | Essex              |
| P1                       | Connector, 10 Pin                                | 149369    | Montronics         |
| Q1, Q2                   | Transistor                                       | 2N697     | Motorola           |
| R1                       | Potentiometer, Series 4,<br>Type 600-1, 500 ohms | 600-1     | Centralab          |
| R2, 3                    | Resistor, composition, 1/4 W,<br>5%, 15 ohms     | 147876    | Montronics         |
| R4                       | Resistor, composition, 1/4 W,<br>5%, 15 K        | 148114    | Montronics         |
| R5                       | Resistor, composition, 1/4 W,<br>5%, 220 ohms    | 147868    | Montronics         |
| T1, 2                    | Transformer                                      | 203-604   | Montronics         |
| T3                       | Transformer                                      | 203-606   | Montronics         |
|                          | Terminal Post                                    | 2010B     | Litton Industries  |
|                          | Transipads                                       | 152207    | Montronics         |
|                          | 1 MC Amplifier PCB                               | 203-3-306 | Montronics         |



5 MC AMPLIFIER, 203-3-405, Drawing No. 203-3-105

| Reference<br>Designation | Description                                      | Type      | Manufacturer      |
|--------------------------|--------------------------------------------------|-----------|-------------------|
| C1, 2                    | Capacitor, dipped mica, 1500 pf<br>5%            | 148361    | Montronics        |
| C3                       | Capacitor, dipped mica, 270 pf<br>5%             | 148452    | Montronics        |
| C4                       | Capacitor, disc, .05 uf, 50 V<br>+80%, -20%      | 149161    | Montronics        |
| C5                       | Capacitor, dipped mica, 120 pf<br>5%             | 148486    | Montronics        |
| C6, 7                    | Capacitor, dipped mica, 5 pf<br>5%               | 148577    | Montronics        |
| CR1                      | Diode                                            | 154799    | Montronics        |
| FL1                      | Inductor, 22 uh, 10%                             | 147843    | Montronics        |
| P1                       | Connector, 10 Pin                                | 149369    | Montronics        |
| Q1, Q2                   | Transistor                                       | 2N2218    | Motorola          |
| R1                       | Potentiometer, Series 4,<br>Type 600-1, 500 ohms | 600-1     | Centralab         |
| R2, 3                    | Resistor, composition, 1/4 W,<br>5%, 15 ohms     | 147876    | Montronics        |
| R4                       | Resistor, composition, 1/4 W,<br>5%, 68 K        | 148171    | Montronics        |
| R5                       | Resistor, composition, 1/4 W,<br>5%, 10 ohms     | 147967    | Montronics        |
| T1, 2                    | Transformer                                      | 203-607   | Montronics        |
|                          | Terminal Post                                    | 2010B     | Litton Industries |
|                          | Transipads                                       | 152207    | Montronics        |
|                          | 5 MC Amplifier PCB                               | 203-3-305 | Montronics        |



CHASSIS, 203-3-400, Drawing No. 203-3-100

| Reference<br>Designation | Description                              | Type        | Manufacturer        |
|--------------------------|------------------------------------------|-------------|---------------------|
| C1                       | Capacitor, electrolytic, 1500 uf<br>50 V | 505-3832-02 | Sangamo<br>Electric |
| C2, 3                    | Capacitor, Disc, .05 uf, 500 V           | 105676      | Montronics          |
| C4                       | Capacitor, electrolytic, 100 uf<br>25 V  | 106518      | Montronics          |
| DS1                      | Lamp                                     | 153106      | Montronics          |
|                          | Light Holder, pilot                      | 153114      | Montronics          |
| F1                       | Fuse, 1/2 amp, Slo-Blo                   | 109322      | Montronics          |
|                          | Fuse Holder                              | 100107      | Montronics          |
| J1 through J33           | Connector, BNC                           | 152033      | Montronics          |
| J34 through 67           | Connector, 10 Pin                        | 149401      | Montronics          |
| Q1                       | Transistor                               | 2N297A      | Motorola            |
|                          | Transistor Mounting Kit                  | MK-20       | Motorola            |
| R1, 2 & 3                | Potentiometer, 2 K ohms                  | 112466      | Montronics          |
| S1                       | Switch, toggle, SPST, 3A                 | 114850      | Montronics          |
| T1                       | Transformer                              | 203-651     | Montronics          |



## WARRANTY

MONTRONICS, INC., warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken:

1. Notify MONTRONICS, INC., giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forwarded to you.
2. On receipt of the shipping instructions, forward the instrument, prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the Warranty.

## SHIPPING

All shipments of MONTRONICS, INC., instruments should be made via airfreight prepaid. The instrument should be shipped in the original packing carton, or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

## CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to MONTRONICS, INC. Upon receipt of this report you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

MONTRONICS, INC., will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to:

MONTRONICS, INC., SUBSIDIARY OF JOHN FLUKE MFG. CO., INC., P. O.  
BOX 7428, SEATTLE 33, WASHINGTON, 98133. TELEPHONE (206) 776-3141



| REVISIONS |      |             |               |
|-----------|------|-------------|---------------|
| SYM       | ZONE | DESCRIPTION | DATE APPROVAL |

SMC PREAMP IMC PRE AMP .IMC PRE AMP  
203-3-104 203-3-103 203-3-102

|    |        |        |          |
|----|--------|--------|----------|
| C1 | 1000PF | 3900PF | .037UF   |
| C2 | 1000PF | 5000PF | .037UF   |
| C3 | 5PF    | 5PF    | NOT USED |
| C4 | 5PF    | 5PF    | NOT USED |
| C5 | .05UF  | .05UF  | .68UF    |

|    |            |            |          |
|----|------------|------------|----------|
| R1 | 390Ω       | 470Ω       | 680Ω     |
| R2 | 10Ω        | 15Ω        | 15Ω      |
| R3 | 10Ω        | 15Ω        | 15Ω      |
| R4 | 15KΩ       | 15KΩ       | 15KΩ     |
| R5 | NOT USED   | NOT USED   | NOT USED |
| R6 | 2.2KΩ 1/2W | 2.2KΩ 1/2W | 2.2KΩ    |

|    |         |         |         |
|----|---------|---------|---------|
| TI | 203-619 | 203-618 | 203-613 |
| TZ | 203-607 | 203-604 | 203-610 |

|    |        |        |        |
|----|--------|--------|--------|
| Q1 | 2N2218 | 2N2218 | 2N2218 |
| Q2 | 2N2218 | 2N2218 | 2N2218 |

|     |      |       |       |
|-----|------|-------|-------|
| FL1 | 22UH | 330UH | 330UH |
|-----|------|-------|-------|

|     |        |        |        |
|-----|--------|--------|--------|
| CR1 | 1N483B | 1N483B | 1N483B |
| PI  |        |        |        |

10 / PI

| Y D | PART OR IDENTIFYING NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | ZONE | MATERIAL | FINISH | PT - MK | SYM | ITEM NO. |
|-----|----------------------------|-----------------------------|------------|------|----------|--------|---------|-----|----------|
|-----|----------------------------|-----------------------------|------------|------|----------|--------|---------|-----|----------|

#### LIST OF MATERIAL

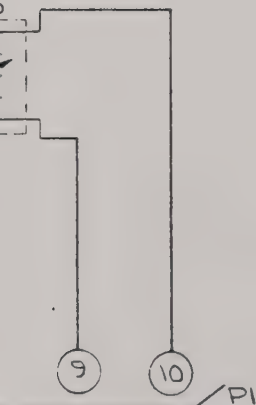
|                                                   |                 |                   |          |                                                                                                                                                                                      |  |
|---------------------------------------------------|-----------------|-------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| NOT SCALE DRAWING                                 |                 | ELEC APPD         | DATE     |  <b>MONTRONICS INC.</b><br>BOZEMAN, MONTANA<br><small>SUBSIDIARY OF JOHN FLUKE MFG CO INC</small> |  |
| LESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES |                 | MECH APPD         |          |                                                                                                                                                                                      |  |
| AR                                                |                 | CHECKED           |          | SMC, IMC, .IMC<br>PRE-AMPLIFIER                                                                                                                                                      |  |
| 2 PL                                              |                 | DRAWN             | 12/29/64 |                                                                                                                                                                                      |  |
| 3 PL                                              |                 | LAURENCE MITCHELL |          | CODE IDENT NO. <b>C</b> 203-3-104-5<br>103-1<br>102-1                                                                                                                                |  |
| ONING & TOLERANCING PER                           | DESIGN APPROVAL |                   | SCALE    |                                                                                                                                                                                      |  |
| MARKING IN ACCORDANCE                             |                 | 12/30/64          |          |                                                                                                                                                                                      |  |
| ML - SPD - 130A                                   |                 |                   |          |                                                                                                                                                                                      |  |



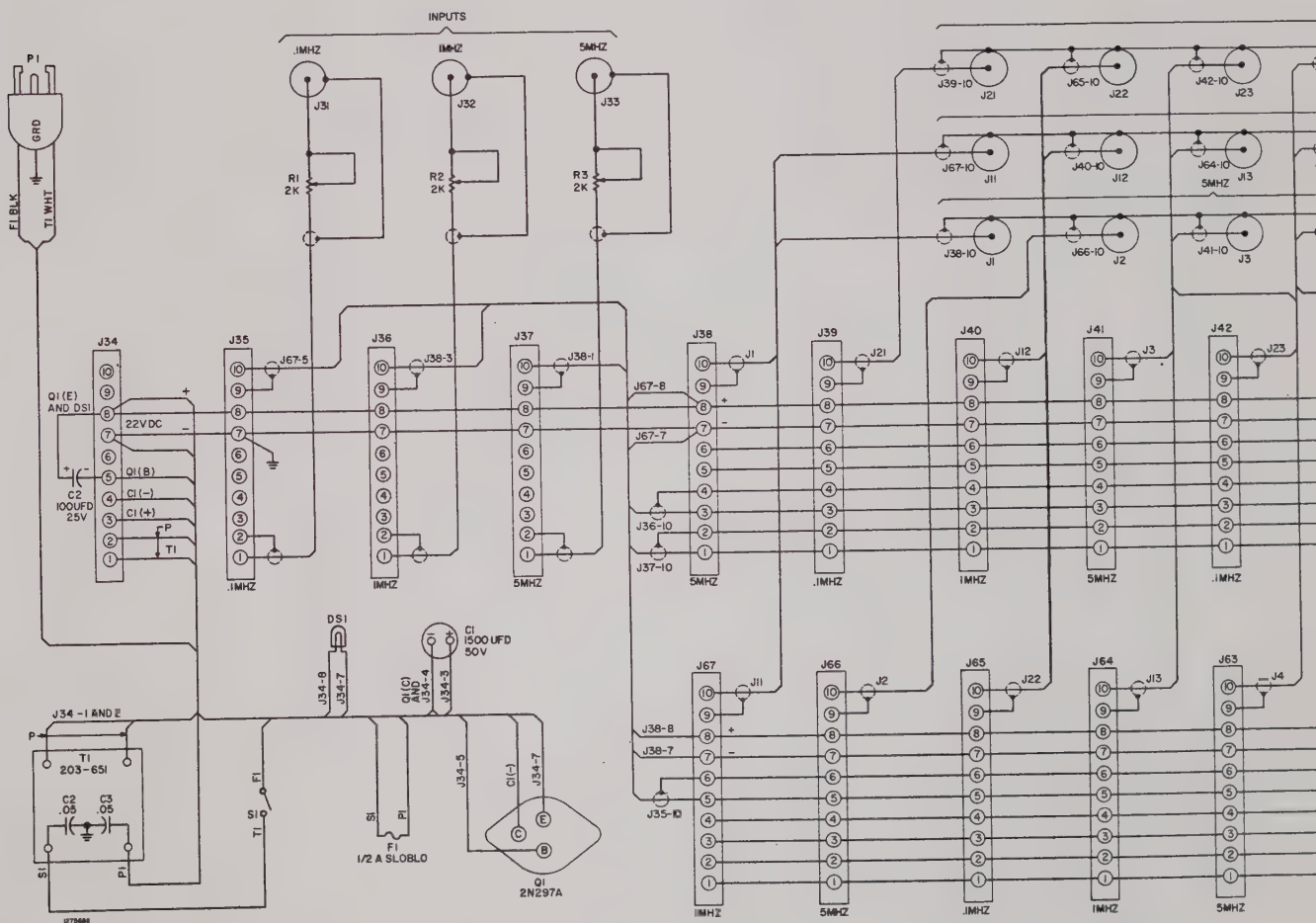
| REVISIONS |      |             |               |
|-----------|------|-------------|---------------|
| SYM       | ZONE | DESCRIPTION | DATE APPROVAL |

|            | SMC AMP<br>203-3-105 | IMC AMP<br>203-3-106 | IMC AMP<br>203-3-107 |
|------------|----------------------|----------------------|----------------------|
| INPUT PINS | 1 & 2                | 3 & 4                | 5 & 6                |
| C1         | 1500 PF              | 5000 PF              | .037 UF              |
| C2         | 1500 PF              | 5000 PF              | .015 UF              |
| C3         | 270 PF               | 1200 PF              | .01 UF               |
| C4         | .05 UF               | .05 UF               | .68 UF               |
| C5         | 120 PF               | 330 PF               | 1500 PF              |
| C6         | 5 PF                 | 5 PF                 | NOT USED             |
| C7         | 5 PF                 | 5 PF                 | NOT USED             |
| R1         | 500 $\Omega$         | 500 $\Omega$         | 10K $\Omega$         |
| R2         | 15 $\Omega$          | 15 $\Omega$          | 15 $\Omega$          |
| R3         | 15 $\Omega$          | 15 $\Omega$          | 15 $\Omega$          |
| R4         | 68K $\Omega$         | 15K $\Omega$         | 15K $\Omega$         |
| R5         | 10 $\Omega$          | 220 $\Omega$         | 10 $\Omega$          |
| T1         | 203-607              | 203-604              | 203-610              |
| T2         | 203-607              | 203-604              | 203-611              |
| T3         | 203-609              | 203-606              | 203-612              |
| Q1         | 2N2218               | 2N697                | 2N697                |
| Q2         | 2N2218               | 2N697                | 2N697                |
| FL1        | 22 UH                | 330 UH               | 330 UH               |
| CR1        | 1N483B               | 1N483B               | 1N483B               |

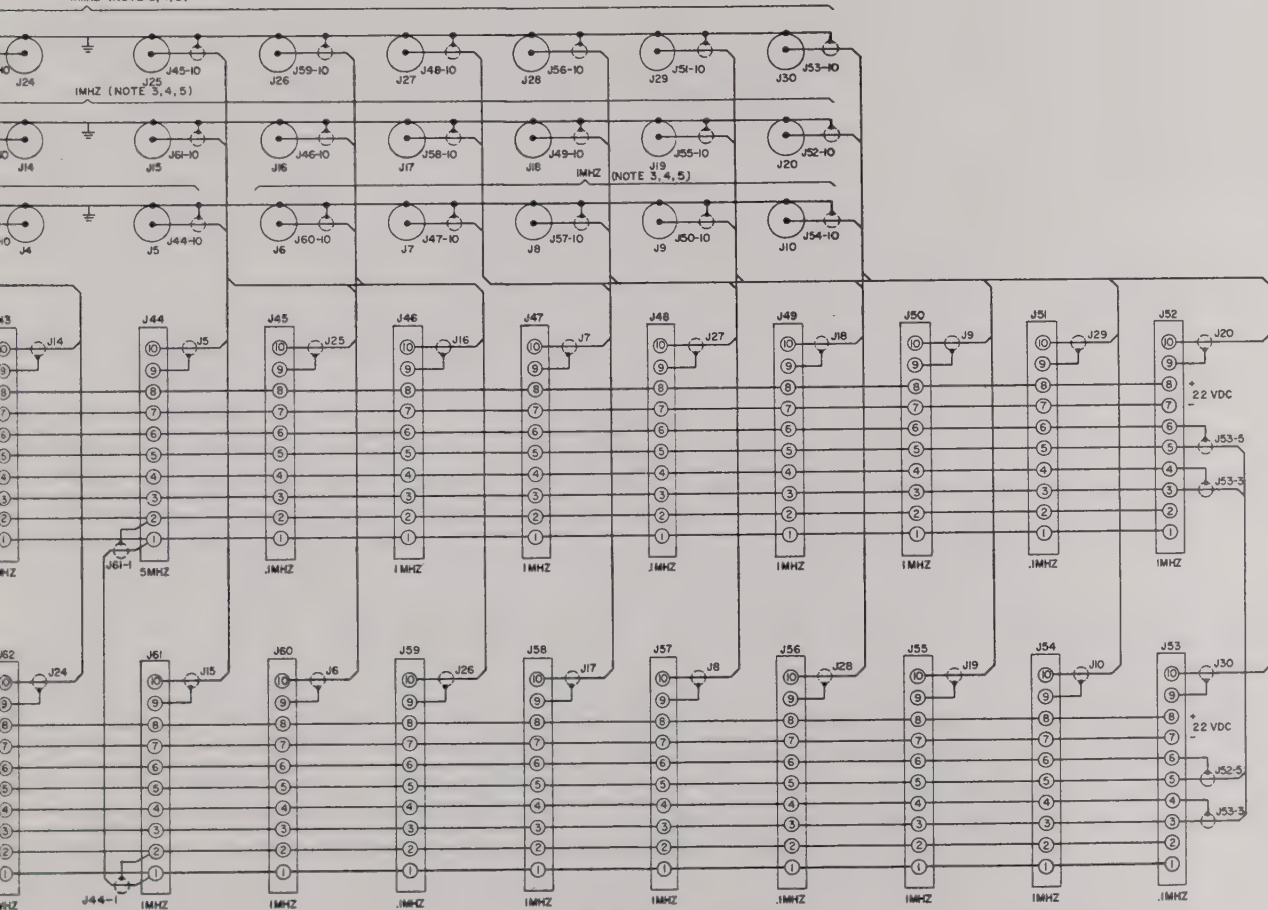
P1



|                                     |                             |            |                                                                                                                                    |          |                               |        |     |          |
|-------------------------------------|-----------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------|--------|-----|----------|
| PART OR IDENTIFYING NUMBER          | NOMENCLATURE OR DESCRIPTION | CODE IDENT | ZONE                                                                                                                               | MATERIAL | FINISH                        | PT. MK | SYM | ITEM NO. |
| LIST OF MATERIAL                    |                             |            |                                                                                                                                    |          |                               |        |     |          |
| NOT SCALE DRAWING                   | ELEC APPD                   | DATE       | <b>MONTRONICS INC.</b><br>BOZEMAN, MONTANA<br><small>SUBS. DIARY OF JOHN FLUXE MFG CO. INC.</small><br>SMC, IMC, IMC<br>AMPLIFIERS |          |                               |        |     |          |
|                                     | MECH APPD                   |            |                                                                                                                                    |          |                               |        |     |          |
|                                     | CHECKED                     |            |                                                                                                                                    |          |                               |        |     |          |
|                                     | DRAWN                       | 3/1/64     |                                                                                                                                    |          |                               |        |     |          |
| DESIGN & TOLERANCING PER            | DESIGN APPROVAL             |            | CODE IDENT NO.                                                                                                                     | SIZE     | 203-3-105-5<br>106-1<br>107-1 |        |     |          |
| WORKING IN ACCORDANCE<br>STD - 130A | 12/30/64                    |            | SCALE                                                                                                                              | SHEET    |                               |        |     |          |



OUTPUT CHANNELS  
1MHZ (NOTE 3, 4, 5)



NOTES:

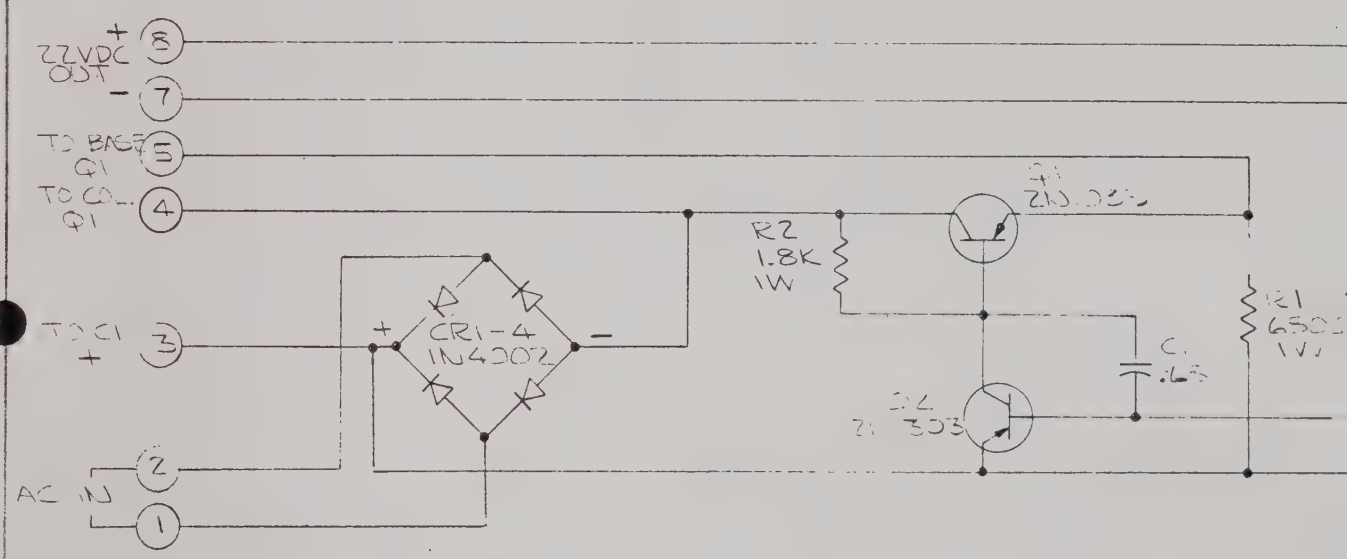
1. J35-37 PRE-AMPLIFIERS
2. J38-67 AMPLIFIERS
3. AT BDA AND MAD - UNIT 1 AS SHOWN  
UNIT 2, J6 THRU J20 ARE 5 MHZ,  
J21 THRU J30 ARE 1 MHZ

4. AT GDS AND MIL-UNIT 1, J1 THRU J10 ARE 5 MHZ,  
J11 THRU J20 ARE 1 MHZ,  
J21 THRU J30 ARE 0.1 MHZ
5. AT GDS AND MIL-UNIT 2, J1 THRU J30 ARE 5 MHZ

CHASSIS WIRING DIAGRAM

Revised November 3, 1975

| APPLICATION |               |          | THIS DRAWING OR SPECIFICATION CONSTITUTES THE CONFIDENTIAL INFORMATION OF MONTRONICS INC. AND ITS RECEIPT OR POSSESSION DOES NOT CONVEY ANY RIGHT IN OR LICENSE TO USE IT OR THIS DRAWING OR SPECIFICATION NOR ANY PART HEREOF WITHOUT THE WRITTEN CONSENT OF MONTRONICS INC. | SYM | ZONE | D |
|-------------|---------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|---|
| NEXT ASSY   | SERIAL NUMBER | PART NO. |                                                                                                                                                                                                                                                                               |     |      |   |



### NOTES

1. Q1 & Q2 USE 104562 TRANSISTOR HEATSINKS
2. ALL CAPACITOR VALUES ARE IN UFD

|                 |         |                |
|-----------------|---------|----------------|
| ELEC APPD       | DATE    | BOZEMAN        |
| MECH APPD       |         |                |
| CHECKED         |         |                |
| DRAWN           |         |                |
| DESIGN APPROVAL | 12/2/14 | CODE IDENT NO. |
|                 |         | SCALE          |

CTIONS

ION

DATE

APPROVAL

KS  
1002

B  
S.L  
N  
W

ONTRONICS. INC.

MONTANA

R SUPPLY

203-3-101

SHEET



## TYPEFACE SPECIMEN SHEET

Copy for revised pages in technical manual ME-1653 was prepared using an IBM Executive Typewriter with bold-face 2 typeface. Repro is enlarged to 112%.



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Goddard Space Flight Center  
Greenbelt, Maryland 20771

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Code 864.1

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Title: \_\_\_\_\_

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or P. O. box)



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# Typeface Specimen Sheet

The typeface used on this revision dated  
March 7, 1969, is IBM Bold Face Number 1.





